



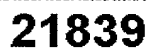
IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Box PATENT APPLICATION

Sir:

Also enclosed are:

- ☒ 10 sheet(s) of [] formal [X] informal drawing(s);
- [X] a claim for foreign priority under 35 U.S.C. §§ 119 and/or 365 is [] hereby made to __
filed in __ on __;
[X] in the declaration;
- [] a certified copy of the priority document;
- [] a General Authorization for Petitions for Extensions of Time and Payment of Fees;
- [] _____ statement(s) claiming small entity status;
- [] an Assignment document;
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- [X] An [] executed [X] unexecuted declaration of the inventor(s)
[X] also is enclosed [] will follow.
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☒ The filing fee has been calculated as follows ☐ and in accordance with the enclosed preliminary amendment:

CLAIMS					
	NO. OF CLAIMS		EXTRA CLAIMS	RATE	FEE
Basic Application Fee					\$690.00 (101)
Total Claims	20	MINUS 20 =	0	x \$18.00 (103)	0
Independent Claims	6	MINUS 3 =	3	x \$78.00 (102)	\$234.00
If multiple dependent claims are presented, add \$260.00 (104)					0
Total Application Fee					\$924.00
If verified Statement claiming small entity status is enclosed, subtract 50% of Total Application Fee					0
Add Assignment Recording Fee if Assignment document is enclosed					0
TOTAL APPLICATION FEE DUE					\$924.00

- ☐ This application is being filed without a filing fee. Issuance of a Notice to File Missing Parts of Application is respectfully requested.
- ☒ A check in the amount of \$ 924.00 is enclosed for the fee due.
- ☐ Charge \$ _____ to Deposit Account No. 02-4800 for the fee due.
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Please address all correspondence concerning the present application to:

Platon N. Mandros
Burns, Doane, Swecker & Mathis, L.L.P.
P.O. Box 1404
Alexandria, Virginia 22313-1404.

Respectfully submitted,

BURNS, DOANE, SWECKER & MATHIS, L.L.P.

Date: June 23, 2000

By:

Platon N. Mandros
Registration No. 22,124

P.O. Box 1404
Alexandria, Virginia 22313-1404
(703) 836-6620

IMAGE PROCESSING FOR IMAGE CORRECTION

This application is based on application No. 11-180460 filed in Japan, the contents of which are hereby
5 incorporated by reference.

BACKGROUND OF THE INVENTION

FIELD OF THE INVENTION

The present invention relates to image correction
10 of color image.

DESCRIPTION OF PRIOR ART

As to digital image data, especially color digital
image data, various types of correction are performed on
input image data. It is known that after digital image data
15 are analyzed, the analysis result is presented in a user
interface and that parameters for image processing are
inputted by a user. For example, in an image processing
described in Japanese Patent laid open Publication 10-
20 233934/1998, color attributes (value, chroma and hue) of a
color in an object image are analyzed, and they are adjusted
in an interactive way. For example, value information is
analyzed, and the analysis result is displayed as a
histogram of value. Then, an operator instructs to increase
25 or decrease the value by referring to the graphic

presentation. Then, image correction is performed by using the instructed parameters. For example, the histogram is expanded to adjust the image according to the analysis results.

5 However, for a general user, it is difficult to set parameters of color attributes for image correction or to correct the parameters when an unsatisfactory correction result is obtained. For example, for an image having color fog, it is difficult to set parameters in correspondence to
10 the color fog. Therefore, it is favorable to easily reflect user's wish in image correction.

SUMMARY OF THE INVENTION

15 An object of the present invention is to allow a user correct image data easily according to results of image analysis.

20 In one aspect of the invention, in the image processing, a controller analyzes image data to determine a characteristic thereof, and corrects the image data with the first correction parameter, and a display device displays the characteristic of the image data and a first correction parameter in correspondence to the characteristic in a screen. A user can instruct with an instruction device to set a second correction parameter in the screen. The
25 controller corrects the image data with the second

correction parameter when the user sets the second correction parameter.

In another aspect of the invention, in the image processing, a controller analyzes image data to determine a characteristic thereof and corrects the image data automatically with a correction parameter in correspondence to the characteristic of the image data. A display device displays the characteristic of the image data obtained by the controller in a screen after the image data is corrected by the controller. If a user is not satisfied with the result, a user can change the image correction with reference to the characteristic of the image presented in the screen.

An advantage of the present invention is that automatic image correction becomes more successful.

BRIEF DESCRIPTION OF THE DRAWINGS

These and other objects and features of the present invention will become clear from the following description taken in conjunction with the preferred embodiments thereof with reference to the accompanying drawings, and in which:

Fig. 1 is a diagram of an entire image processor;

Fig. 2 is a block diagram of a controller and thereabout;

Fig. 3 is a main flowchart in a first embodiment of the invention;

Fig. 4 is a flowchart of changing a graphic user interface while displaying image analysis results;

5 Fig. 5 is a flowchart of parameter setting;

Fig. 6 is a diagram of window presentation for setting parameters;

Fig. 7 is a flowchart of default operation;

10 Fig. 8 is a diagram of window presentation for setting operation on color fog correction;

Fig. 9 is a main flowchart in a second embodiment of the invention;

15 Fig. 10 is a diagram of a window presentation when a backlight image is decided as a normal image and corrected automatically;

Fig. 11 is a diagram of an example of window presentation for setting parameters; and

20 Fig. 12 is a diagram of another example of window presentation for setting parameters.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring now to the drawings, wherein like reference characters designate like or corresponding parts throughout the several views, Fig. 1 shows an entire image processing apparatus according to a first embodiment of the

25

invention. It has a controller (computer) 1 which controls the entire apparatus, as a central component. In Fig. 1, arrows show directions of data flow. A display device 2 displays various screens provided for operation or image processing as well as an image or characters in a screen. A keyboard 3 and a mouse 4 are used for various inputs and instructions by a user. A flexible disk 5 and a hard disk 6 are storage media for storing, for example, image data, attribute information and programs. The apparatus has a flexible disk drive and a hard disk drive for accessing the flexible disk 5 and the hard disk 6. A printer 7 prints image data or the like on a paper. A scanner 8 reads image data of a document. A CD-ROM 9 is a recording medium for storing various data or programs, and the apparatus has a CD-ROM drive for accessing the CD-ROM 9. Programs explained later are read from an external recording medium such as a CD-ROM.

Fig. 2 is a block diagram of the controller 1 and thereabout. The controller 1 has a central processing unit (CPU) 210, and it is connected via a bus 220 to a read-only-memory (ROM) 203 for storing various data and a random access memory (RAM) for storing various data and programs. Further, it is also connected via the bus 220 to a display controller 205 for displaying images and characters in a screen of the display apparatus 2, a keyboard controller 206

for controlling key-input from the keyboard 3, a mouse controller for controlling an input from the mouse 4, a flexible disk controller 208 which controls the flexible disk drive, a hard disk controller 209 for controlling the hard disk 6, a printer controller 210 which controls outputs to the printer 7, a scanner controller 211 which controls the scanner 8, and a CD-ROM drive controller 212 which controls the CD-ROM drive. Further, in the controller, a clock circuit 202 generates various clock signals for operating the apparatus. Further, extension slots 215 are connected to the bus for connecting various extension boards to which for example a SCSI board is connected for connecting a flexible disk drive, a hard disk drive, a scanner, a CD-ROM drive or the like. Further, it is also connected via an interface card to a network (web). In this apparatus, the flexible disk 5 and the hard disk 6 are used as storage media, but other medium such as a magneto-optical disk may also be used. The scanner 8 and the CD-ROM 9 are used for inputting image data, but another input device such as a still video camera may also be used. The printer 7 is used as an output device, but a digital copying machine or the like may also be used.

In this apparatus, image data are corrected in an image correction routine which includes presentation of image analysis result. When start of image correction is

instructed by a user, the routine is evoked. The image correction routine further includes image file input/output processing, image data display processing, a graphic user interface processing for image correction operation, error processing in the graphic user interface processing, and resolution change processing, but they are not explained here. The structures of the image processing apparatus shown in Figs. 1 and 2 are common in other embodiments which will be explained later.

Presentation of image analysis result in image correction is explained below. In this processing, image data is analyzed, and the analysis result thereof is displayed in a screen of the display device 2 to inform a correction parameter on image correction to a user while setting the correction parameter based on the analysis.

Next, a first embodiment of the invention is explained. In this embodiment, image analysis result (characteristics of image) is displayed and a user can set a different correction parameter on the image.

Fig. 3 shows a main flowchart of image correction. First, image data obtained by the scanner 8 is received and stored in a memory (step S10), and the image data is analyzed (step S12). In the analysis, histograms of R, G, B data, value data or the like are prepared, and image data are divided into areas. A scene such as color fog,

backlight, underexposure, overexposure, night scene or the like is decided. Next, the image analysis result is displayed in the screen of the display apparatus 2 and the graphic user interface (GUI) is changed (step S14, refer to Fig. 6). Next, a correction parameter may be inputted by a user (step S16). The correction parameter such as "weak color fog" or "backlight" is determined beforehand in correspondence to the characteristic of the image obtained by the image analysis. A user observes the image analysis result and the recommended correction parameter in the screen and changes the correction parameter if necessary. The "correction parameter" which a user sets or changes is not a correction parameter on color components, but a correction parameter represented in the screen with a sentence, such as "correct color fog weakly" or "correct backlight". The image processor interprets the correction parameter as parameters for color processing operation for "correct color fog weakly" or "correct backlight", and corrects the image with the parameters. Next, image correction is performed with the input correction parameter (step S18). For example, color fog is deleted.

Fig. 4 shows a flowchart of changing a graphic user interface while displaying the image analysis result. First, the image analysis result is displayed in the screen (step S30). That is, a scene decided as a result of image

analysis is displayed. For example, a scene where "weak color fog exists" is displayed. Next, a parameter and an operation for the scene of the analysis result are set (step S32). As an example of the processing, parameter setting for color fog correction is explained with reference to Figs. 5 and 6.

Fig. 5 is a flowchart of parameter setting for color fog correction (step S32 in Fig. 4). The flow branches according to the analysis result of color fog image (refer to step S12 in Fig. 3) (step S50). When weak color fog is detected, the correction parameter is set to "correct weakly" and it is displayed in the screen (step S52). When strong color fog is detected, the correction parameter is set to "correct strongly" and it is displayed in the screen (step S54). When no color fog is detected, the correction parameter is set to "no correction" and it is displayed in the screen (step S56). Next, the image is subjected to image correction, and the image after correction is displayed in the screen (step S58). Thus, a preview image after correction with the parameter are displayed in the screen.

Fig. 6 shows an example of a screen (window) in the display apparatus 2 for setting the parameter in color fog correction. At the lower left side, three color fog parameters ("No correction", "Correct weakly" and "Correct

strongly") are presented. In this example, weak color fog is detected. Therefore, a mark in correspondence to "Correct weakly" is selected as the parameter, and a sentence therefor is displayed at the lower right side.

5 Further, an image before correction is displayed at the upper left side, while an image subjected to weak color fog correction (preview image) is displayed at the upper right side. By observing the screen, a user can understand the image analysis result and the recommended parameter and can
10 operate the correction only by clicking "RUN" button. If a user does not satisfy the analysis result by observing the preview image, he can press "CANCEL" button to change the parameter. For example, if the correction is insufficient, the value for the insufficient parameter may be changed
15 according to the analysis result.

Fig. 7 is a flowchart of default operation for color fog correction (step S32 in Fig. 4). When color fog is detected (YES at step S70), "RUN" button is displayed as a default button in the screen (step S72). On the other
20 hand, When color fog is not detected (NO at step S70), "CANCEL" button is displayed as a default button in the screen (step S74).

Fig. 8 shows an example of a screen (window) in the display apparatus 2 for setting default operation on
25 color fog correction. In this example, weak color fog is

detected, and "CORRECT" button is recommended as the default button. When the correction is performed, a user can understand the image analysis result and operate only by pressing "ENTER" key.

5 Next a second embodiment of the invention is explained. In this embodiment, the image analysis result is explained after the automatic correction. Fig. 9 is a main flowchart of this embodiment. First, an image is read and stored in a memory (step S100), and it is analyzed (step
10 S102). Similarly to the first embodiment, histograms of R, G, B data, value data or the like are prepared, and image data are divided into areas. Then, a scene such as color fog, backlight, underexposure, overexposure, night scene or the like is decided. Image correction is performed based on
15 image analysis result (step S104), wherein the parameter is adjusted automatically according to the analysis result of step S102 and image correction is performed with the parameter (step S106). Next, an image after the correction is displayed (step S106), and the image analysis result is
20 also displayed (step S108). If a user does not satisfy the image after correction (NO at step S110), he adjusts the parameter based on to the analysis result (step S112), and the image is corrected again (step S114).

Fig. 10 shows an example of a screen (window) of
25 the display apparatus when a backlight image is decided

erroneously as a normal image and corrected automatically. It is understood from the screen that the image is decided as a normal image, and this means that the image is corrected with the parameter for normal correction. If this
5 automatic correction is different from user's intention, the user can understand the cause thereof. Therefore, it is understood easily how the parameter is set for obtaining the intended image. Further, a satisfactory result can be obtained simply by changing the parameter. In this case, a
10 user does not satisfy the analysis result because the image is an image under backlight.

Then, a user presses the cancel button shown in Fig. 10, to cancel the correction. Next, the correction parameter is changed, and execution of correction is
15 instructed. By referring to screens (windows) of the display apparatus 2 for setting parameters shown in Figs. 11 and 12, steps in Fig. 10 for changing the correction parameter and executing image correction are explained. Figs. 11 and 12 show that four types of correction parameter
20 of normal, backlight, color fog and night scene can be set. Further, Fig. 11 shows that the default value of the correction parameter is set to "CORRECT FOR NORMAL IMAGE" according to the analysis result. However, a user does not satisfy the analysis result and sets "CORRECT FOR BACKLIGHT
25 IMAGE" as correction parameter and presses "RUN" button to

performed desired correction. Fig. 12 shows that "CORRECT FOR BACKLIGHT IMAGE" is selected as correction parameter.

As explained above, the image analysis result is displayed in the screen, it helps a user to understand how to change the correction parameter when a desired image is not obtained due to erroneous decision of the scene or the like and the correction parameter on the image is changed manually. Even a beginner can understand easily what parameter has to be set.

For example, in the above example, it is decided that the image has weak color fog, and a button for color fog deletion is set in an enabled state. Further, there are three correction parameters of NO, WEAK and STRONG on color fog deletion, and "WEAK" is set in a selected state.

As in the example in the second embodiment, when a backlight image is dealt as a normal image, the correction parameter of "CORRECT FOR NORMAL IMAGE" is displayed. Then, a user presses the cancel button to clear the correction result, and sets the parameter for correction on backlight image.

In the above-mentioned embodiments, RGB image is processed. However, the above processing is applicable not only to RGB image, but also to Bayer image dealt in a digital camera.

It is an advantage that correction parameter is

displayed besides the image analysis result, a user can operate image correction without inputting correction parameter. Even a beginner can understand easily what correction parameter has to be set. It is helpful to
5 determine how to change the correction parameter when a desired image is not obtained due to erroneous decision of scene or the like and correction parameter is corrected manually. When a user performs desired correction, it is understood what correction parameter is changed. For
10 example, when correction is insufficient, an insufficient parameter is increased relative to the analysis result.

Although the present invention has been fully described in connection with the preferred embodiments thereof with reference to the accompanying drawings, it is
15 to be noted that various changes and modifications are apparent to those skilled in the art. Such changes and modifications are to be understood as included within the scope of the present invention as defined by the appended claims unless they depart therefrom.

WHAT IS CLAIMED IS:

1. An image processor comprising:

a controller which analyzes image data to determine a characteristic thereof and corrects the image data with a first correction parameter in correspondence to the characteristic;

a display device which displays the characteristic of the image data obtained by said controller and the first correction parameter in correspondence to the characteristic of the image data in a screen; and

an instruction device which instructs by a user to set a second correction parameter in the screen of said display device;

wherein said controller corrects the image data with the second correction parameter when the user sets the second correction parameter with said instruction device.

2. The image processor according to claim 1, wherein said instruction device sets the first correction parameter obtained by said controller as a default correction parameter.

3. The image processor according to claim 1, wherein said display device displays the first correction parameter in correspondence to the characteristic and correction parameters not in correspondence to the characteristic of the image data.

4. The image processor according to claim 1, wherein said display device further displays an image which has been corrected by said controller with the first correction parameter.

5. An image processor comprising:

a controller which analyzes image data to determine a characteristic thereof and corrects the image data automatically with a correction parameter in correspondence to the characteristic of the image data; and

a display device which displays the characteristic of the image data obtained by said controller in a screen after the image data is corrected by said controller.

6. The image processor according to claim 5, wherein said display device displays an image of the image data which have been corrected by said controller.

7. The image processor according to claim 6, further comprising a canceler which cancels the image correction by said controller.

8. The image processor according to claim 6, wherein said display device displays the correction parameter in correspondence to the characteristic of the image data obtained by said controller and different correction parameters not in correspondence to the characteristic.

9. The image processor according to claim 8, further comprising an instruction device which instructs by a user

to set one of the different correction parameters in the screen.

10. An image processing method comprising the steps of:

5 analyzing image data to determine a characteristic of the image;

displaying the characteristic of the image data and a first correction parameter in correspondence to the characteristic in a screen of a display device;

10 setting a second correction parameter in the screen of the display device by a user; and

correcting the image data with the first correction parameter obtained by the analysis or with the second correction parameter when the user sets the second correction parameter.

11. An image processing method comprising the steps of:

analyzing image data to determine a characteristic of the image;

20 correcting the image data automatically with a correction parameter in correspondence to the characteristic of the image data; and

displaying the characteristic of the image data in a screen after the image data have been corrected.

25 12. A computer readable storage medium storing a

program comprising the steps of:

analyzing image data to determine a characteristic thereof;

5 displaying the characteristic of the image data and a first correction parameter in correspondence to the characteristic in a screen of a display device;

instructing by a user to set a second correction parameter in the screen of the display device; and

10 correcting the image data with the first correction parameter or with the second correction parameter when the user sets the second correction parameter.

13. The computer readable storage medium according to claim 12, said program further comprising the step of setting the first correction parameter as a default
15 correction parameter.

14. The computer readable storage medium according to claim 12, wherein in said displaying step, the first correction parameter in correspondence to the characteristic and correction parameters not in correspondence to the
20 characteristic are displayed in the screen.

15. The computer readable storage medium according to claim 12, wherein in said displaying step, an image which has been corrected by said image corrector is displayed further.

25 16. A computer readable storage medium storing a

program comprising the steps of:

analyzing image data to determine a characteristic thereof;

5 correcting the image data automatically with a correction parameter in correspondence to the characteristic of the image data; and

displaying the characteristic of the image data in a screen after the image data is corrected.

10 17. The computer readable storage medium according to claim 16, wherein in said displaying step, the image data which have been corrected by said image corrector is displayed in the screen.

15 18. The computer readable storage medium according to claim 16, wherein said program further comprising the step of canceling the image correction in said correcting step.

20 19. The computer readable storage medium according to claim 16, wherein in said displaying step the correction parameter in correspondence to the characteristic obtained by said analyzer and different correction parameters not in correspondence to the characteristic are displayed.

20. The computer readable storage medium according to claim 19, wherein said program further comprising the step of instructing by a user to set one of the different correction parameters in the screen.

In the processing of image data, image data are analyzed to determine a characteristic of the image, and the characteristic and a first correction parameter in correspondence to the characteristic are displayed in a screen of a display device. A second correction parameter may be set in the screen of the display device by a user. The image data is corrected with the first correction parameter, but when the user sets a second correction parameter, the image data are corrected with the second correction parameter. Alternatively, The image data are corrected automatically with the first correction parameter, and the characteristic of the image data is displayed in a screen after the image data have been corrected.

Fig.2

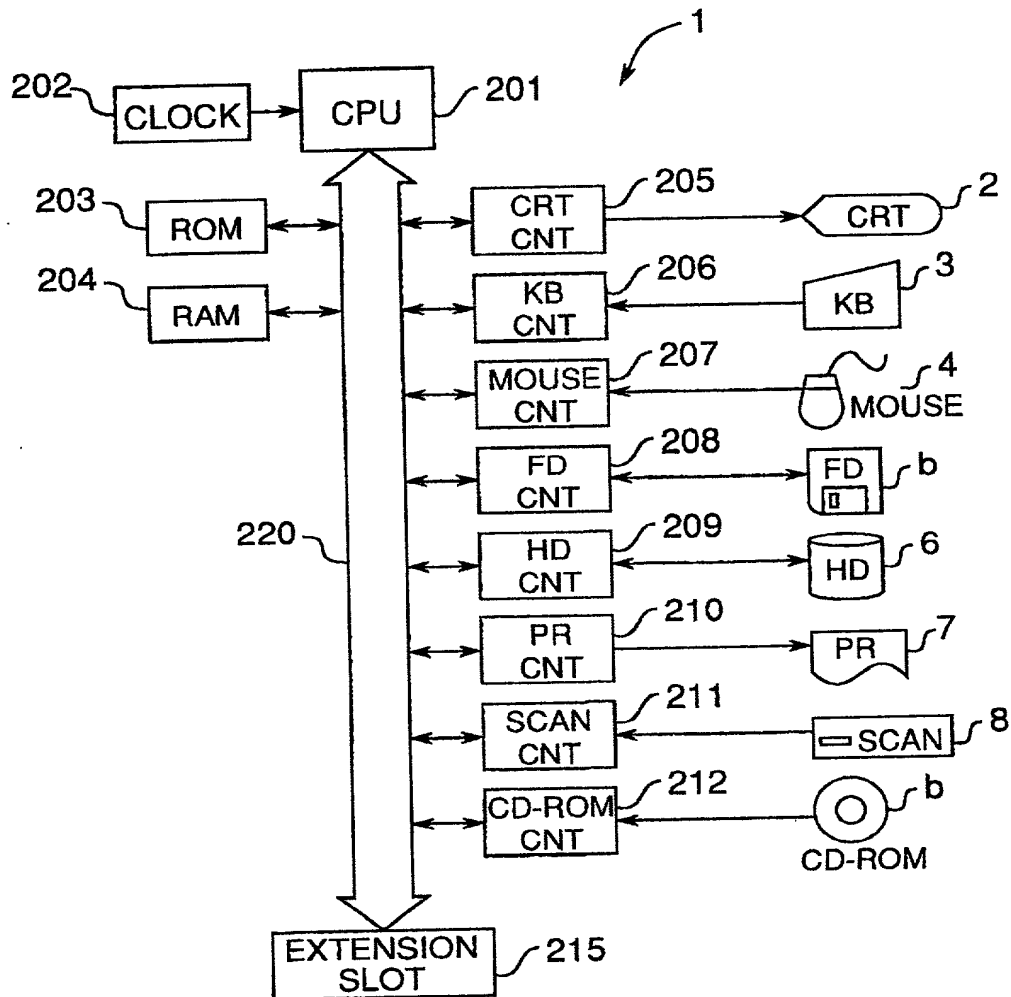


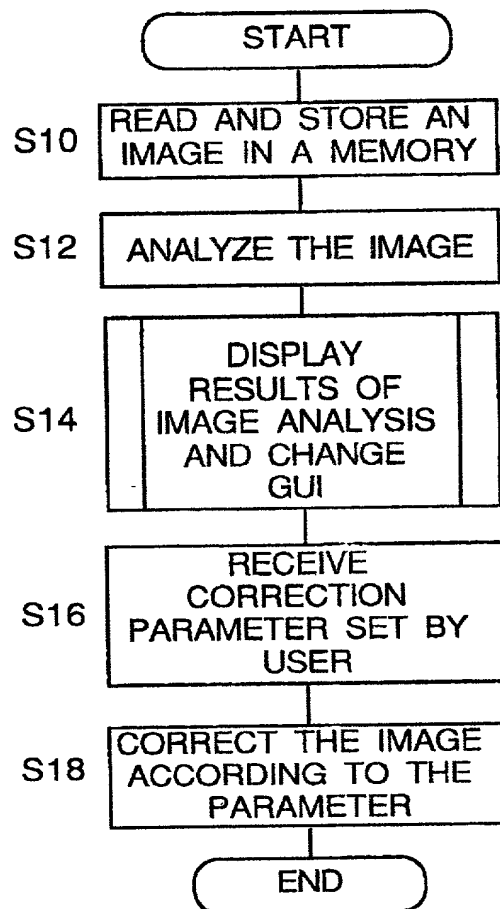
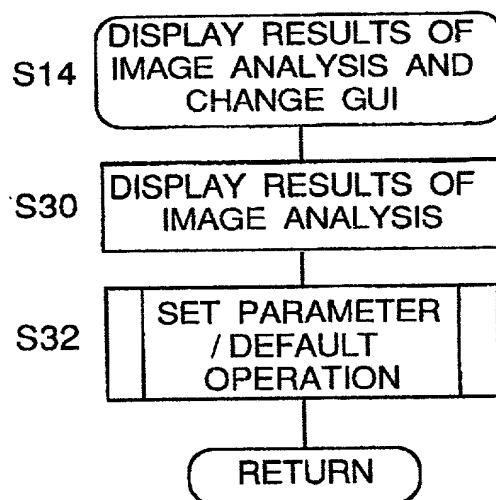
Fig.3*Fig.4*

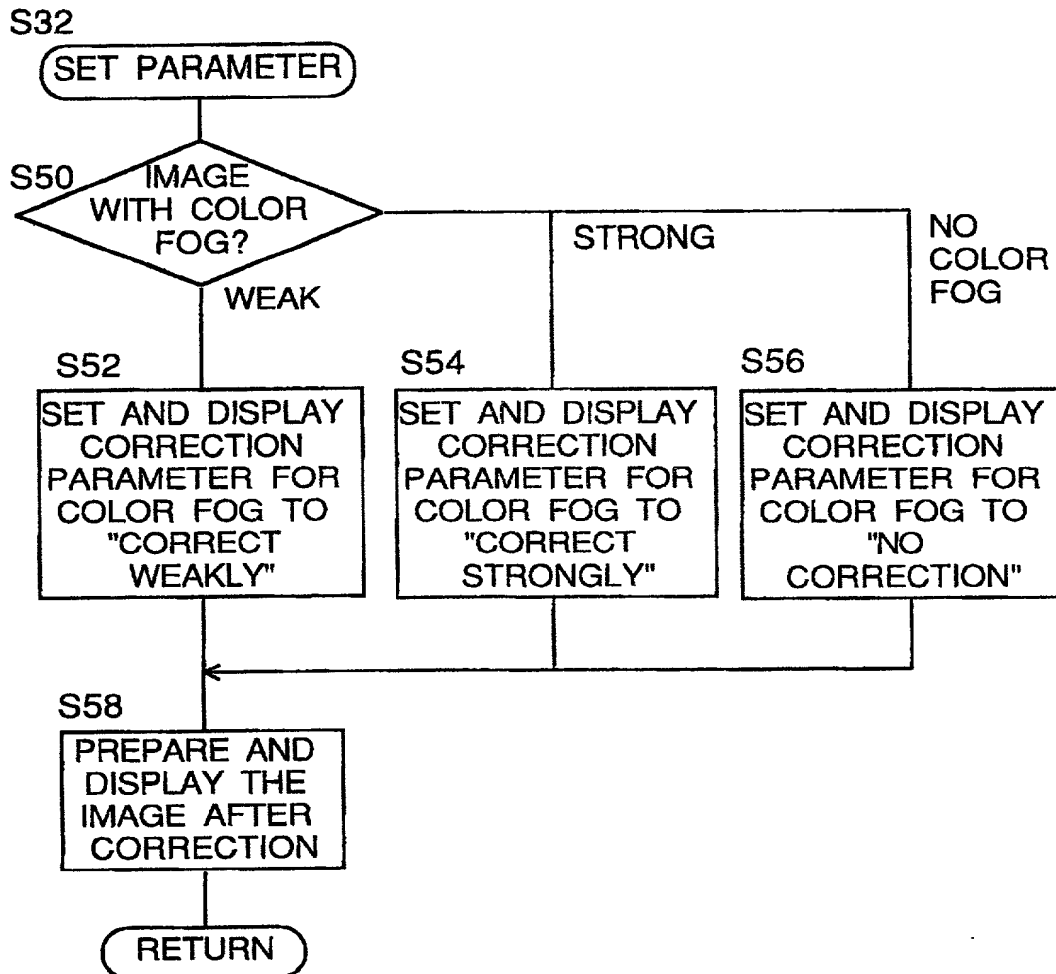
Fig.5

Fig.6

(IMAGE BEFORE CORRECTION) → (IMAGE AFTER CORRECTION)

☐ NO CORRECTION
☒ CORRECT WEAKLY
☐ CORRECT STRONGLY

IMAGE ANALYSIS RESULT
WEAK COLOR FOG
IS DETECTED

RUN CANCEL

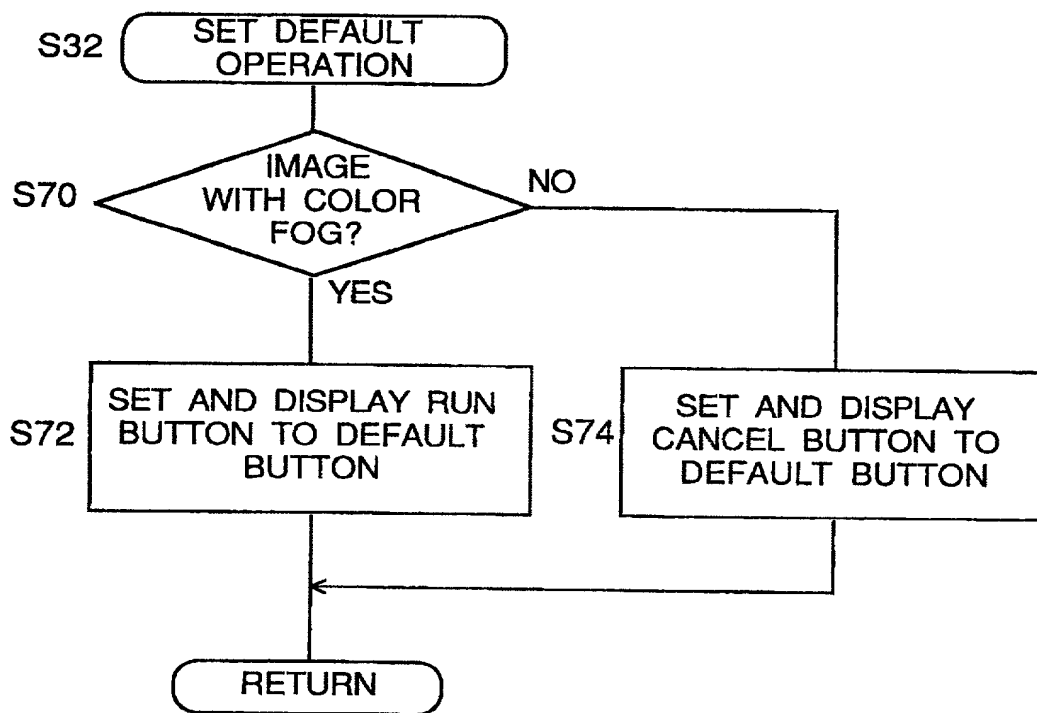
Fig.7

Fig.8

COLOR FOG CORRECTION

ENTER

IMAGE ANALYSIS RESULT
COLOR FOG IS DETECTED

CORRECT

CANCEL

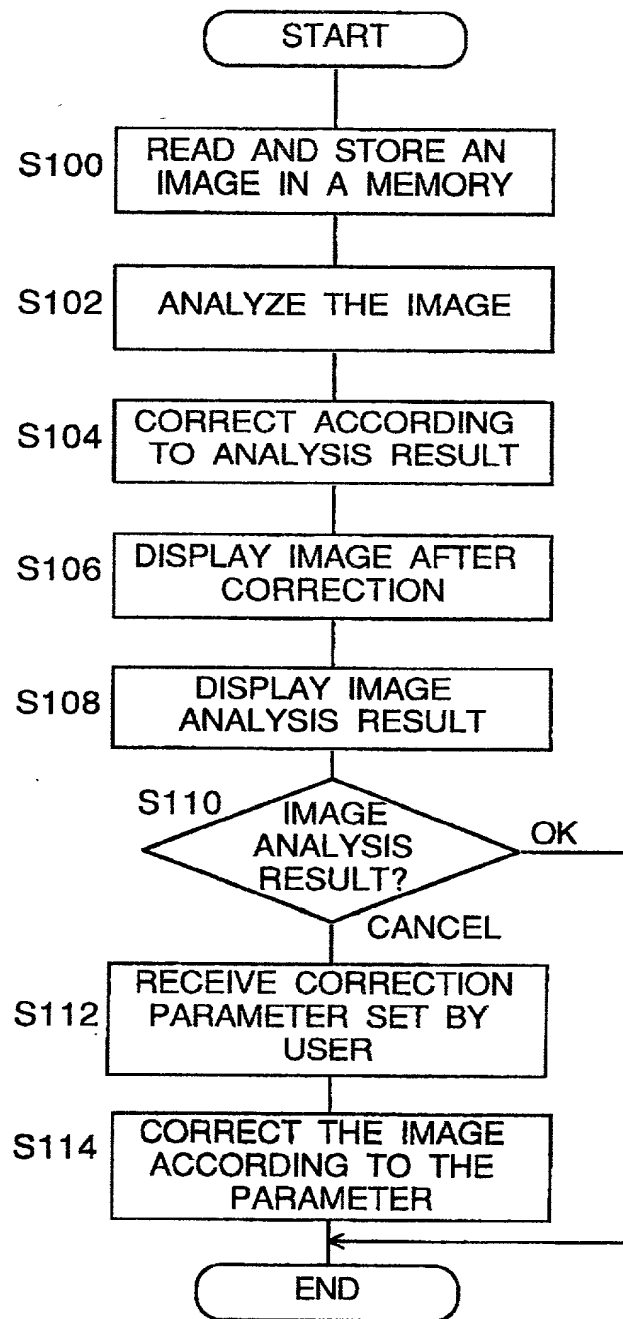
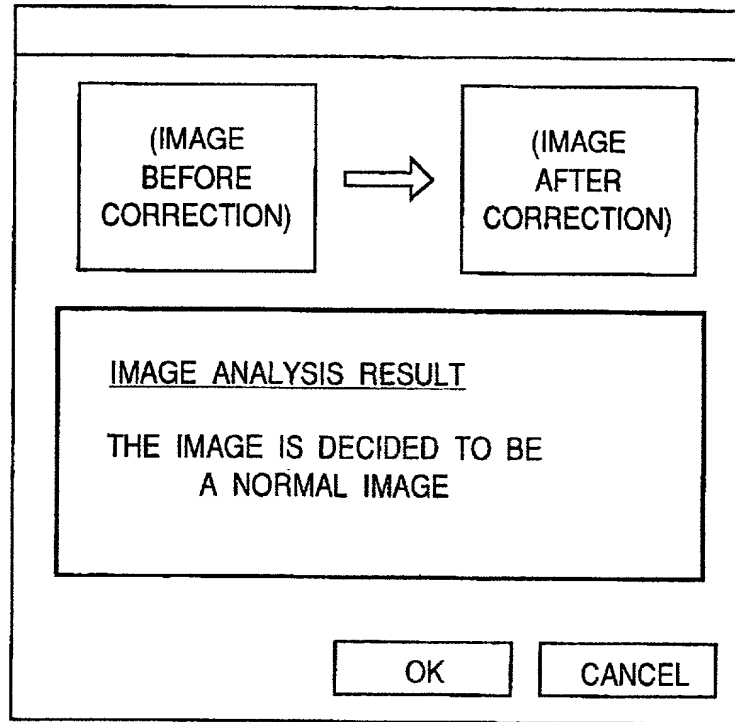
Fig.9

Fig.10*Fig.11*

The diagram shows a software window with a title bar. Inside, the text "SET CORRECTION PARAMETER" is at the top. Below it are five radio button options: "NO CORRECTION", "CORRECT FOR NORMAL IMAGE", "CORRECT FOR BACKLIGHT IMAGE", "CORRECT FOR IMAGE WITH COLOR FOG", and "CORRECT FOR IMAGE AT NIGHT". The "CORRECT FOR NORMAL IMAGE" option is selected, indicated by a filled circle. At the bottom right of the window are two buttons labeled "RUN" and "CANCEL".

**COMBINED DECLARATION AND POWER OF ATTORNEY
FOR UTILITY PATENT APPLICATION**

Attorney's Docket No.

018775-794

As a below-named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below next to my name;

I BELIEVE I AM THE ORIGINAL, FIRST AND SOLE INVENTOR (if only one name is listed below) OR AN ORIGINAL, FIRST AND JOINT INVENTOR (if more than one name is listed below) OF THE SUBJECT MATTER WHICH IS CLAIMED AND FOR WHICH A PATENT IS SOUGHT ON THE INVENTION ENTITLED:

IMAGE PROCESSING FOR IMAGE CORRECTION

the specification of which

(check one)

☒ is attached hereto;

☐ was filed on _____ as

Application No. _____

and was amended on _____;
(if applicable)

I HAVE REVIEWED AND UNDERSTAND THE CONTENTS OF THE ABOVE-IDENTIFIED SPECIFICATION, INCLUDING THE CLAIMS, AS AMENDED BY ANY AMENDMENT REFERRED TO ABOVE;

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I hereby claim foreign priority benefits under Title 35, United States Code Sec. 119 and/or Sec. 365 of any foreign application(s) for patent or inventor's certificate as indicated below and have also identified below any foreign application for patent or inventor's certificate on this invention having a filing date before that of the application(s) on which priority is claimed:

COMBINED DECLARATION AND POWER OF ATTORNEY

Attorney's Docket No.

018775-794

COUNTRY/INTERNATIONAL	APPLICATION NUMBER	DATE OF FILING (day, month, year)	PRIORITY CLAIMED
JAPAN	11-180460	25 June 99	YES <u>X</u> NO <u> </u>
			YES <u> </u> NO <u> </u>

I hereby appoint the following attorneys and agent(s) to prosecute said application and to transact all business in the Patent and Trademark Office connected therewith and to file, prosecute and to transact all business in connection with international applications directed to said invention:

William L. Mathis	17,337	R. Danny Huntington	27,903	Gerald F. Swiss	30,113
Robert S. Swecker	19,885	Eric H. Weisblatt	30,505	Michael J. Ure	33,089
Platon N. Mandros	22,124	James W. Peterson	26,057	Charles F. Wieland III	33,096
Benton S. Duffett, Jr.	22,030	Teresa Stanek Rea	30,427	Bruce T. Wieder	33,815
Norman H. Stepmo	22,716	Robert E. Krebs	25,885	Todd R. Walters	34,040
Ronald L. Grudziecki	24,970	William C. Rowland	30,888	Ronni S. Jillions	31,979
Frederick G. Michaud, Jr.	26,003	T. Gene Dillahunt	25,423	Harold R. Brown III	36,341
Alan E. Kopecki	25,813	Patrick C. Keane	32,858	Allen R. Baum	36,086
Regis E. Slutter	26,999	Bruce J. Boggs, Jr.	32,344	Steven M. du Bois	35,023
Samuel C. Miller, III	27,360	William H. Benz	25,952	Brian P. O'Shaughnessy	32,747
Robert G. Mukai	28,531	Peter K. Skiff	31,917	Kenneth B. Leffler	36,075
George A. Hovanec, Jr.	28,223	Richard J. McGrath	29,195	Fred W. Hathaway	32,236
James A. LaBarre	28,632	Matthew L. Schneider	32,814		
E. Joseph Gess	28,510	Michael G. Savage	32,596		

**21839**

and: _____

Address all correspondence to:

**21839**

Platon N. Mandros
BURNS, DOANE, SWECKER & MATHIS, L.L.P.
P.O. Box 1404
Alexandria, Virginia 22313-1404

Address all telephone calls to: Platon N. Mandros at (703) 836-6620.

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Kagumi MORIWAKI		
RESIDENCE	CITIZENSHIP	
	Japan	
POST OFFICE ADDRESS		
c/o Minolta Co., Ltd., Osaka Kokusai Building, 3-13, 2-Chome, Azuchi-Machi, Chuo-Ku, Osaka-Shi, Osaka, 541-8556, Japan		
FULL NAME OF SECOND JOINT INVENTOR, IF ANY	SIGNATURE	DATE
RESIDENCE	CITIZENSHIP	
POST OFFICE ADDRESS		